Active Noise Control using Combustion Driven Actuators

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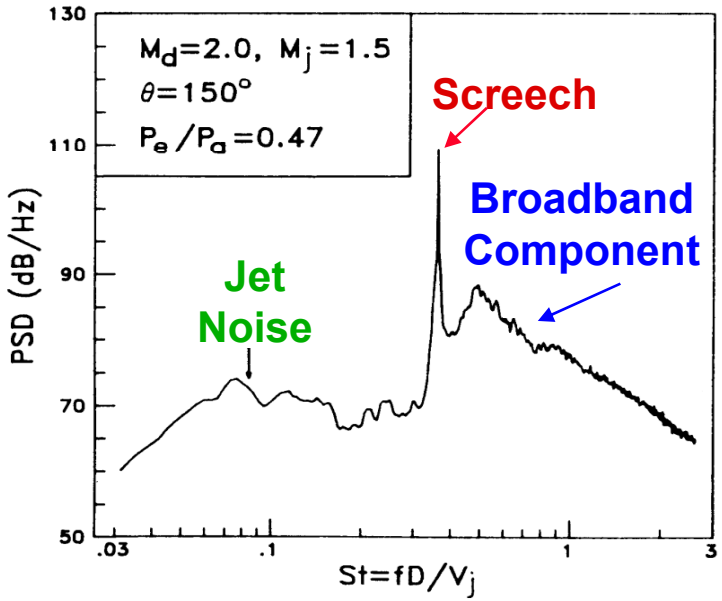
Collaborators/Advisees: Drs. Funk, Glezer, Parekh, Neumier

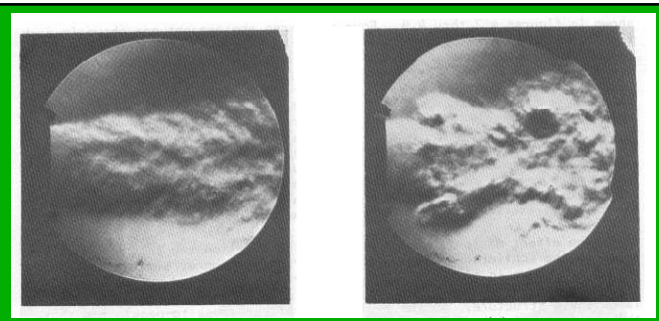
Project Duration: 5 Years

Motivation and Objectives

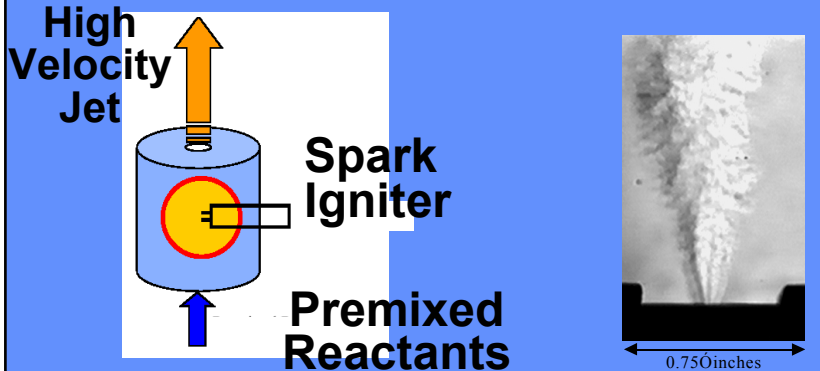
- Aero-engine propulsion system noise continues to be a show stopper for the aviation industry
- Innovative techniques needed to reduce noise of the current and future propulsion systems
- Techniques that have little effect on engine performance and are easily implemented are badly needed



- **Jet Mixing Noise reduces by 24 dB for each halving the jet velocity**
- **Supersonic jet noise stands to gain most by velocity reduction**



Mixing Enhancement via Jet Excitation



Combustion Driven jet Actuator

Approach

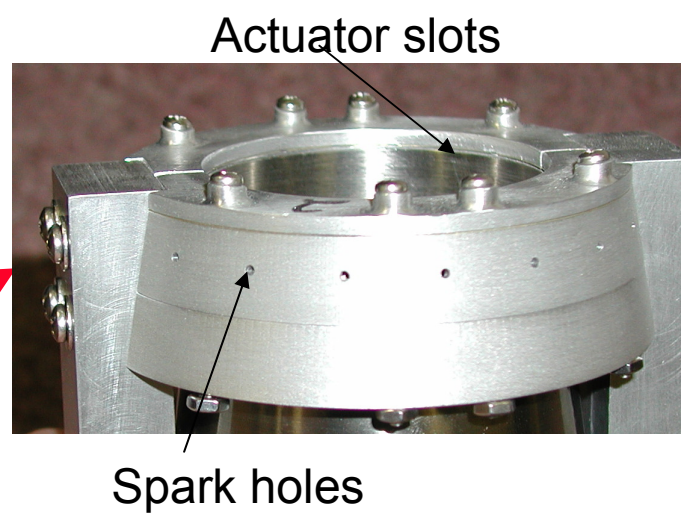
The basis of the approach lies in the fact that enhanced mixing supersonic jets reduces the extent of the supersonic flow and hence the mixing noise, the shock associated noise, and the Mach wave radiation

Key: Optimized Mixing Enhancement Performance

- Step 1- Use lessons from collaborative studies to fine-tune actuator performance
- Step 2 -Test unheated nozzles
  - Open loop control
- Step 3 - Implement closed loop control

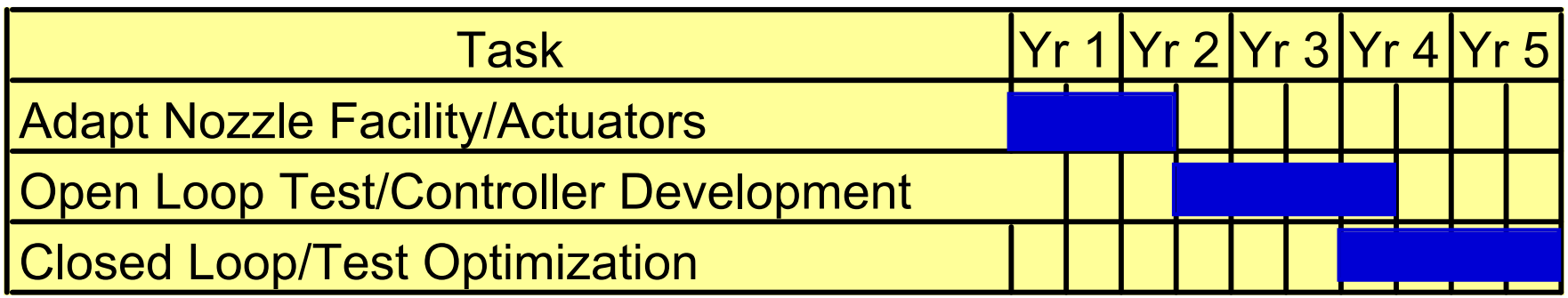
Round and Rectangular Nozzles

The approach will build upon the results of an existing 9-month feasibility-study grant on similar work from Glenn for a round nozzle



Milestones and Expected Accomplishments

- Data for round and a rectangular nozzle in an anechoic chamber using an aeroacoustically clean jet flow facility
- Mixing and noise performance under each step
- Mixing characteristics and farfield acoustic signatures as a function of actuator frequency and amplitude
- Data first with open loop then with closed loop
- Correlation of the data where possible with theoretical models
- Although the focus will be on supersonic flows, the effects on subsonic jets will also be studied



Chances of Success

- We expect major challenges in producing high frequency actuation needed for model scale nozzles , especially at high jet speeds
- Excitation frequency increases with increasing jet speed and decreasing nozzle diameter
- An existing (Phase 1) NASA Glenn NRA program of feasibility study will set the course!
- Air Pulsing experiments on large-scale jets appear very promising
- Chances of success high, but after a few major hurdles and creative solutions